CLAIMS

What is claimed is:

1. A method, comprising:

directing an optical beam into a first end of an optical path having the first end and a second end disposed in a semiconductor substrate;

reflecting a first portion of the optical beam having a first center wavelength back out from the first end of the optical path; and

tuning the optical path to reflect a second portion of the optical beam having a second center wavelength back out from the first end of the optical path.

2. The method of claim 1 further comprising confining the optical beam to remain within the optical path between the first and second ends with an optical waveguide disposed in the semiconductor substrate between the first and second ends.

3. The method of claim 1 wherein tuning the optical path comprises adjusting an effective index of refraction of the optical path through the semiconductor substrate along the optical path.

4. The method of claim 1 wherein tuning the optical path comprises adjusting a temperature of the semiconductor substrate with a heater disposed proximate to the optical path through the semiconductor substrate.

5. The method of claim 1 wherein tuning the optical path comprises modulating charge in the optical path through the semiconductor substrate in response to a modulating signal.

6. The method of claim 5 wherein in modulating charge in the optical path comprises modulating a voltage of the modulation signal applied to a conductive element of a conductor-insulator-semiconductor structure included along the optical path.

7. The method of claim 1 wherein reflecting the first portion of the optical beam comprises perturbing an effective index of refraction a plurality of times along the optical path to form a Bragg grating.

8. The method of claim 7 wherein perturbing the effective index of refraction the plurality of times along the optical path comprises periodically or quasi-periodically disposing silicon and polysilicon in the semiconductor substrate along the optical path.

9. The method of claim 7 wherein perturbing the effective index of refraction the plurality of times along the optical path comprises periodically or quasi-periodically changing a geometry of the optical path along the optical path.

10. An apparatus, comprising:

a semiconductor substrate;

a heater disposed proximate to the semiconductor substrate;

an optical path through the semiconductor substrate, wherein a temperature of the semiconductor substrate including the optical path is responsive to the heater; and

a plurality of perturbations of a refractive index of the semiconductor substrate along the optical path, the refractive index of the semiconductor substrate responsive to the temperature of the semiconductor substrate.

11. The apparatus of claim 10 further comprising an optical waveguide disposed in the semiconductor substrate, the optical waveguide including the optical path.

12. The apparatus of claim 11 wherein the optical waveguide disposed in the semiconductor substrate comprises an optical rib waveguide.

13. The apparatus of claim 10 further comprising:

a first optical confinement layer disposed proximate to the semiconductor substrate layer; and

a second optical confinement layer disposed proximate to the semiconductor substrate layer such that the semiconductor substrate layer is disposed between the first and second optical confinement layers.

14. The apparatus of claim 13 further comprising a second semiconductor substrate layer disposed proximate to the second optical confinement layer such that the second optical confinement layer is disposed between the semiconductor substrate layer and the second semiconductor substrate layer.

15. The apparatus of claim 14 wherein the semiconductor substrate, the second semiconductor substrate, the first optical confinement layer and the second optical confinement layer are included in a silicon-on-insulator wafer.

16. The apparatus of claim 10 wherein the plurality of perturbations of the refractive index of the semiconductor substrate along the optical path are provided with periodic regions of silicon and polysilicon disposed in the semiconductor substrate along the optical path.

17. The apparatus of claim 16 wherein the periodic regions of silicon and polysilicon provide a uniform Bragg grating disposed in the semiconductor substrate.

18. The apparatus of claim 10 wherein the plurality of perturbations of the refractive index of the semiconductor substrate along the optical path are provided with quasi-periodic regions of silicon and polysilicon disposed in the semiconductor substrate along the optical path.

19. The apparatus of claim 18 wherein the quasi-periodic regions of silicon and polysilicon provide an apodized Bragg grating disposed in the semiconductor substrate.

20. The apparatus of claim 10 wherein the heater comprises a thin-film heater.

21. An apparatus, comprising:

a semiconductor substrate;

an optical path through the semiconductor substrate; and

a plurality of perturbations of a refractive index of the semiconductor substrate along the optical path; and

a plurality of charge modulated regions disposed in the optical path.

22. The apparatus of claim 21 further comprising an optical waveguide disposed in the semiconductor substrate, the optical waveguide including the optical path.

23. The apparatus of claim 22 wherein the optical waveguide disposed in the semiconductor substrate includes an optical rib waveguide.

24. The apparatus of claim 21 further comprising:

an insulating layer disposed proximate to the semiconductor substrate; and

a plurality of conductive elements disposed proximate to the insulating layer such that the insulating layer is disposed between the plurality of conductive elements and the semiconductor layer, the plurality of conductive elements coupled to receive a modulation signal, the plurality of charge modulated regions coupled to be modulated in response to the modulation signal.

25. The apparatus of claim 24 further comprising first and second optical confinement layers, the semiconductor substrate disposed between the first and second optical confinement layers, the first optical confinement layer including the insulating layer.

26. The apparatus of claim 21 wherein the plurality of perturbations of the refractive index of the semiconductor substrate along the optical path are provided with periodic changes in a geometry of the optical path in the semiconductor substrate along the optical path.

27. The apparatus of claim 26 wherein the periodic regions of silicon and polysilicon provide a uniform Bragg grating disposed in the semiconductor substrate.

28. The apparatus of claim 21 wherein the plurality of perturbations of the refractive index of the semiconductor substrate along the optical path are provided with quasi-periodic changes in a geometry of the optical path in the semiconductor substrate along the optical path.

29. The apparatus of claim 28 wherein the quasi-periodic changes in a geometry of the optical path provide an apodized Bragg grating disposed in the semiconductor substrate.